

Geology and Geological Potential for CO₂ Storage and Enhanced Oil Recovery in the Cardium Fm, Pembina Field

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Underground disposal and long-term storage of Carbon Dioxide (CO₂) is an effective and relatively simple mechanism to reduce anthropogenic CO₂ emissions into the atmosphere. This process has economic benefits as well in that CO₂, when injected into mature oil fields, potentially results in increased oil production and recovery. In Alberta, a royalty credit program was introduced in 2003 to encourage companies to initiate CO₂ enhanced oil recovery (EOR) schemes. One such scheme proposed to develop an EOR pilot project in the Cardium Fm in Twp. 48, Rge.9, W 5th Mer. Herein is a summary of the Geology of the pilot project, including the Cardium Fm, bounding shales, and shallow stratigraphy. The Geology is examined from the perspective of long-term leakage potential and storage capacity for CO₂.

The Cardium Formation is subdivided into four units, which comprise the main producing and injection zones. Overlying and underlying the Cardium sandstones and conglomerate are thick sequences of shale. The underlying package, referred to as the Joli Fou to Blackstone shale (JB shale), averages 320 m in thickness. Overlying the Cardium is a 320-metre thick shale (Cardium to Lea Park Shale) that extends from the top of the Cardium conglomerate to the base of the Wapiti Formation. The shallow stratigraphy includes the Wapiti, Scollard and Paskapoo formations. At the pilot site, the Wapiti Formation is 800 m thick and is disconformably overlain by the nearly 500 m thick combined Scollard/Paskapoo unit. Based on detailed geological evaluation of the reservoir, bounding shales and overlying stratigraphy, it is apparent that there is minimal geological potential for CO₂ leakage from the Cardium Formation to surface or into near surface strata. Further, the observed continuity of the Cardium lower, and combined middle and upper sandstones supported by their petrophysical characteristics, indicate that the Cardium Formation is an excellent candidate for storing significant volumes of carbon dioxide.